

Subpoena

What is claimed is:

1. A sandwich structure comprising:
 - a core having foam plastic core members formed of a closed-cell foam plastic material; and
 - surface plates formed of a fiber-reinforced composite material containing hydrophobic inorganic fibers as reinforcing fibers and covering the opposite surfaces of the core;
 - wherein the foam plastic core members are bonded together with adhesive films that do not foam, and the surface plates are bonded to the core with adhesive films not containing any carrier or a component resin of the fiber-reinforced composite material forming the surface plates.

2. A sandwich structure comprising:
 - a core having foam plastic core members formed of a closed-cell foam plastic material and honeycomb core members; and
 - surface plates formed of a fiber-reinforced composite material containing hydrophobic inorganic fibers as reinforcing fibers and covering the opposite surfaces of the core;
 - wherein a peripheral part of the core is formed of the foam plastic core members arranged so as to surround the honeycomb core members, the foam plastic core members are bonded together with adhesive films that do not foam, and the surface plates are bonded to the core with adhesive films not containing any carrier or a component resin of the fiber-reinforced composite material forming the surface plates.

3. A sandwich structure comprising:
 - a core having foam plastic core members formed of a closed-cell foam plastic material and honeycomb core members; and
 - surface plates formed of a fiber-reinforced composite material containing hydrophobic inorganic fibers as reinforcing fibers and covering the opposite surfaces of the core;
 - wherein the core is formed by sandwiching the honeycomb core members between the foam plastic core members and bonding the foam plastic core members to the honeycomb core members with adhesive films not containing any carrier.

4. A sandwich structure comprising:

a core having foam plastic core members formed of a closed-cell foam plastic material and honeycomb core members; and

surface plates formed of a fiber-reinforced composite material containing hydrophobic inorganic fibers as reinforcing fibers and covering the opposite surfaces of the core;

wherein portions of the core corresponding to portions of the sandwich structure where thickness varies sharply are formed of the foam plastic core members, portions of the core corresponding to portions of the sandwich structure where thickness varies gradually are formed of the honeycomb core members, and the surface plates are bonded to the core with adhesive films not containing any carrier or a component resin of the fiber-reinforced composite material forming the surface plates.

Claim 1

5. The sandwich structure according to ~~any one of claims 1 to 4~~ to be used as a structural member of aircraft, rolling stock, an automobile or a ship.

6. A sandwich structure repairing method of repairing a sandwich structure comprising a core having foam plastic core members formed of a closed-cell foam plastic material, and an outer surface plate and an inner surface plate formed of a fiber-reinforced plastic material and bonded to the opposite surfaces of the core with adhesive films not containing any carrier or a component resin of the fiber-reinforced composite material forming the surface plates, said sandwich structure repairing method comprising the steps of:

putting an outer support plate to an inner surface of a damaged portion of the outer surface plate; and

fastening the outer support plate to the outer surface plate with rivets.

7. The sandwich structure repairing method according to claim 6, wherein:

a portion of the inner surface plate and a portion of the core corresponding to the damaged portion of the outer surface plate are removed;

the outer support plate is fastened to the inner surface of the damaged portion of the outer surface plate with rivets; a cavity formed by removing the portion of the core is filled up with a filling material; and

an inner support plate of a size greater than that of an opening in the inner surface plate formed by removing the portion of the inner surface plate is fastened to the inner surface plate with rivets so as to cover the opening in the inner surface plate.

8. The sandwich structure repairing method according to claim 6, wherein:

an opening is formed in the damaged portion of the outer surface plate;

a portion of the core and a portion of the inner surface plate corresponding to the opening and a region around an edge of the opening are removed;

the outer support plate is fastened to the inner surface of a portion of the outer surface plate around an edge of the opening in the outer surface plate with rivets;

a cover plate formed of the same material as that forming the outer surface plate and having a thickness equal to that of the outer surface plate is fitted in the opening and is fastened to the outer support plate with rivets;

a cavity formed in the core by removing the portion of the core is filled up with a filling material; and

an inner support plate of a size greater than that of an opening in the inner surface plate formed by removing the portion of the inner surface plate is fastened to the inner surface plate with rivets so as to cover the opening in the inner surface plate.

9. The sandwich structure repairing method according to claim 6, wherein:

a portion of the outer surface plate including the damaged portion is removed to form an opening in the outer surface plate;

a portion of the core corresponding to the opening in the outer surface plate and a portion of the core around an edge of the opening in the outer surface plate are removed;

the outer support plate is expandable over a region greater than the opening in the outer surface plate;

the outer support plate is inserted through the opening in the outer surface plate;

the outer support plate is fastened to the inner surface of the outer surface plate with rivets;

a cover plate of a size equal to that of the opening formed in the outer surface plate and of a thickness equal to that of the outer surface plate is fitted in the opening in the outer surface plate;

the outer support plate is fastened to the support plate with rivets; and

a cavity formed by removing the portions of the core is filled up with a filling material.

10. The sandwich structure repairing method according to claim 6, wherein:

a plurality of the outer support plates are used;

a portion of the outer surface plate including the damaged portion is removed to form an opening in the outer surface plate;

a portion of the core corresponding to the opening in the outer surface plate and a portion of the core around an edge of the opening in the outer surface plate are removed;

the plurality of the outer support plates are inserted through the opening in the outer surface plate so as to be arranged on the inner surface of a portion of the outer surface plate around an edge of the opening in the outer surface plate;

the plurality of the outer support plates are fastened to the inner surface of the outer surface plate with rivets;

a cover plate of a size equal to that of the opening formed in the outer surface plate and of a thickness equal to that of the outer surface plate is fitted in the opening in the outer surface plate;

the cover plate is fastened to the plurality of the outer support plates with rivets; and

a cavity formed by removing the portions of the core is filled up with a filling material.

11. The sandwich structure repairing method according to ~~any one of claims 6 to 10~~, wherein the portion of the core of a foam plastic material are removed by a shot blasting process.